

CLAIMS

What is claimed is:

1. A material composition comprising:

a first component having a monomer portion and at least one cationically polymerizable functional group;

a crosslinker reactive with said first component and comprising at least three cationically polymerizable functional groups; and

a cationic photoinitiator.

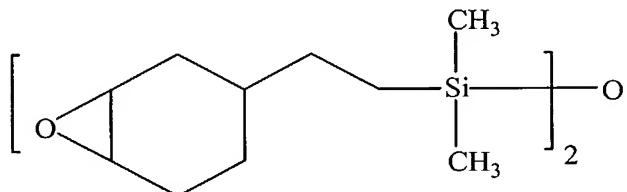
2. A material composition as set forth in claim 1 wherein said first component comprises two cationically polymerizable functional groups.

3. A material composition as set forth in claim 1 wherein said monomer portion of said first component is an organic monomer selected from the group of aryl, norbornane, and combinations thereof.

4. A material composition as set forth in claim 1 wherein said monomer portion of said first component is an organosilicone monomer containing  $(SiR_2O)$  or  $(SiRO_{3/2})$  units, wherein R is hydrogen, a methyl group, a phenyl group, a hydrocarbon, or a fluorocarbon group.

5. A material composition as set forth in claim 1 wherein said cationically polymerizable functional group of said first component is selected from the group of epoxy functional groups, vinyl ether functional groups, and combinations thereof.

6. A material composition as set forth in claim 1 wherein said first component is

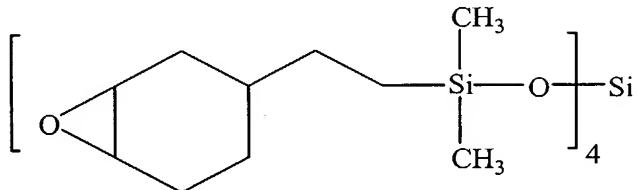


7. A material composition as set forth in claim 1 wherein said crosslinker comprises four cationically polymerizable functional groups.

8. A material composition as set forth in claim 1 wherein said crosslinker comprises silicone.

9. A material composition as set forth in claim 1 wherein said cationically polymerizable function groups of said crosslinker are selected from the group of epoxy functional groups, vinyl ether functional groups, and combinations thereof.

10. A material composition as set forth in claim 1 wherein said crosslinker is



11. A material composition as set forth in claim 1 wherein first component and/or said crosslinker are the reaction product of 4-vinyl-1-cyclohexane-1,2-epoxide and an SiH-functional silicone compound.

12. A material composition as set forth in claim 1 wherein said cationic photoinitiator comprises an active cationic species and an anionic species, with said cationic species comprising an onium salt.

13. A material composition as set forth in claim 12 wherein said onium salt is a diaryliodonium salt, a triarylsulfonium salt, or a tetraaryl phosphonium salt and said anionic species is selected from the group of  $\text{BF}_4^-$ ,  $\text{PF}_6^-$ ,  $\text{AsF}_6^-$ ,  $\text{SbF}_6^-$ , and  $(\text{C}_6\text{F}_5)_4\text{B}^-$ .

14. A material composition as set forth in claim 1 wherein said first component is present from 90-98 parts by weight, said crosslinker is present from 1-9 parts by weight, and said cationic photoinitiator is present from 0.1-2 parts by weight, all based on 100 parts by weight of said material composition.

15. A material composition as set forth in claim 1 further comprising a non-reactive diluent for reducing a viscosity of said material composition.

16. A material composition as set forth in claim 1 wherein said non-reactive diluent is selected from the group of PGMEA, PGME, 2-heptanone, xylene, and combinations thereof.

17. A material composition as set forth in claim 1 further comprising an additive selected from the group of stabilizers, adhesion promoters, mold release agents, and combinations thereof.

18. A material composition as set forth in claim 1 wherein;

said first component comprises two epoxy functional groups and said monomer portion of said first component is an organosilicone monomer; and  
    said crosslinker comprises silicone and four epoxy functional groups.

19. A material composition as set forth in claim 1 wherein said composition is applied on a substrate to form a film by spin-coating, dip-coating, or spray-coating.

20. A material composition as set forth in claim 1 wherein said composition is applied on a substrate as liquid droplets prior to contact printing.

21. Use of the material composition of claim 1 in nanoscale contact printing, nanoimprint lithography (NIL), microimprint lithography, UV-assisted nanoimprint lithography, Step-and-Flash Nanoimprint Lithography (S-FIL), and combined-nanoimprint-and-photolithography.

22. Use of the material composition of claim 1 in a tool selected from the group of contact aligners, nanoimprinters, bonding machines, and presses.

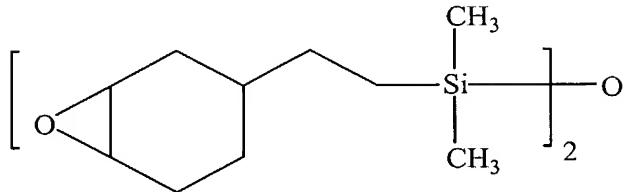
23. Use of the material composition of claim 1 at temperatures between 0 and 100°C and/or at pressures less than 10 atmospheres.

24. A cured resist film comprising the reaction product of:  
 a first component comprising a monomer portion and at least one cationically polymerizable functional group;  
 a crosslinker reactive with said first component and comprising at least three cationically polymerizable functional groups; and  
 a cationic photoinitiator.

25. A cured resist film as set forth in claim 24 wherein said monomer portion of said first component is an organosilicone monomer containing  $(SiR_2O)$  or  $(SiRO_{3/2})$  units, wherein R is hydrogen, a methyl group, a phenyl group, a hydrocarbon, or a fluorocarbon group.

26. A cured resist film as set forth in claim 24 wherein said cationically polymerizable functional group of said first component is selected from the group of epoxy functional groups, vinyl ether functional groups, and combinations thereof.

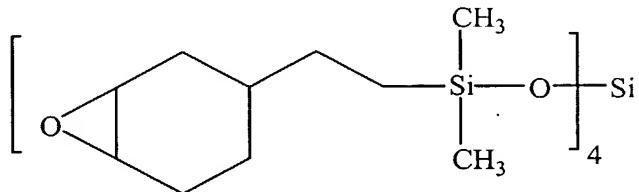
27. A cured resist film as set forth in claim 24 wherein said first component is



28. A cured resist film as set forth in claim 24 wherein said crosslinker comprises silicone.

29. A cured resist film as set forth in claim 24 wherein said cationically polymerizable function groups of said crosslinker are selected from the group of epoxy functional groups, vinyl ether functional groups, and combinations thereof.

30. A cured resist film as set forth in claim 24 wherein said crosslinker is



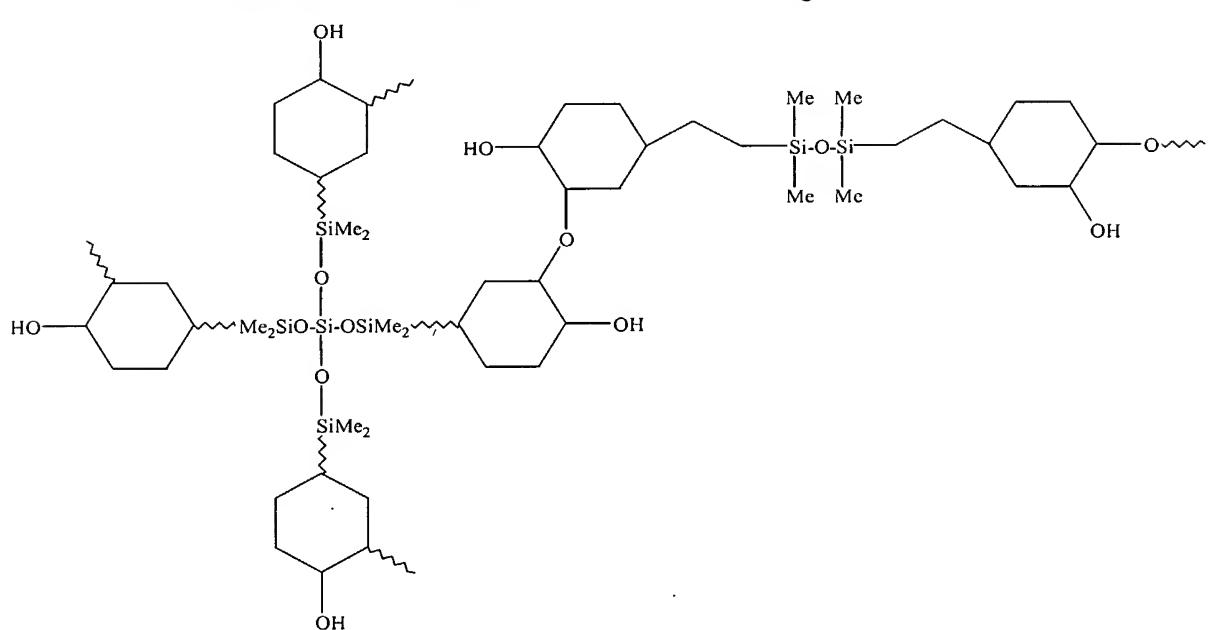
31. A cured resist film as set forth in claim 24 wherein first component and/or said crosslinker are the reaction product of 4-vinyl-1-cyclohexane-1,2-epoxide and an SiH-functional silicone compound.

32. A cured resist film as set forth in claim 24 wherein said first component is present from 90-98 parts by weight, said crosslinker is present from 1-9 parts by weight, and said cationic photoinitiator is present from 0.1-2 parts by weight, all based on 100 parts by weight of said material composition.

33. A cured resist film as set forth in claim 24 further comprising a non-reactive diluent for reducing a viscosity of said material composition.

34. A cured resist film as set forth in claim 24 wherein; said first component comprises two epoxy functional groups and said monomer portion of said first component is an organosilicone monomer; and said crosslinker comprises silicone and four epoxy functional groups.

35. A cured resist film as set forth in claim 24 of the general formula;



36. An article comprising:

a substrate layer; and

a resist layer formed on said substrate layer and comprising the reaction product of:

a first component comprising a monomer portion and at least one cationically polymerizable functional group;

a crosslinker reactive with said first component and comprising at least three cationically polymerizable functional groups; and

a cationic photoinitiator.

37. An article as set forth in claim 36 wherein said substrate layer is formed from silicon or glass.

38. An article as set forth in claim 36 further comprising an undercoating layer disposed between said substrate layer and said resist layer.

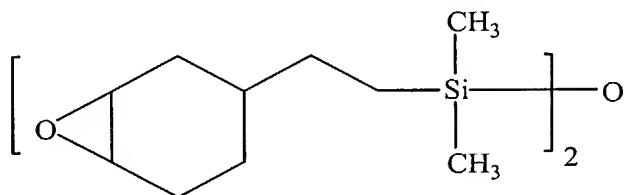
39. An article as set forth in claim 38 wherein said undercoating layer is formed from a polymer.

40. An article as set forth in claim 39 wherein said polymer comprises poly(methyl methacrylate).

41. An article as set forth in claim 36 wherein said monomer portion of said first component is an organosilicone monomer containing  $(SiR_2O)$  or  $(SiRO_{3/2})$  units, wherein R is hydrogen, a methyl group, a phenyl group, a hydrocarbon, or a fluorocarbon group.

42. An article as set forth in claim 36 wherein said cationically polymerizable functional group of said first component is selected from the group of epoxy functional groups, vinyl ether functional groups, and combinations thereof.

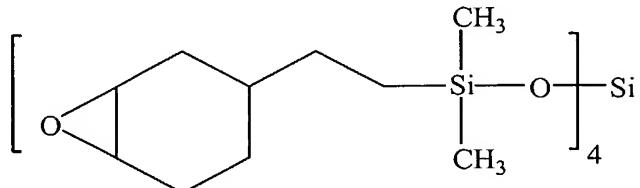
43. An article as set forth in claim 36 wherein said first component is



44. An article as set forth in claim 36 wherein said crosslinker comprises silicone..

45. An article as set forth in claim 36 wherein said cationically polymerizable function groups of said crosslinker are selected from the group of epoxy functional groups, vinyl ether functional groups, and combinations thereof.

46. An article as set forth in claim 24 wherein said crosslinker is



47. An article as set forth in claim 36 wherein first component and/or said crosslinker are the reaction product of 4-vinyl-1-cyclohexane-1,2-epoxide and an SiH-functional silicone compound.

48. An article as set forth in claim 36 wherein said first component is present from 90-98 parts by weight, said crosslinker is present from 1-9 parts by weight, and said cationic photoinitiator is present from 0.1-2 parts by weight, all based on 100 parts by weight of said material composition.

49. An article as set forth in claim 36 further comprising a non-reactive diluent for reducing a viscosity of said material composition.

50. An article as set forth in claim 36 wherein;  
said first component comprises two epoxy functional groups and said monomer portion of said first component is an organosilicone monomer; and  
said crosslinker comprises silicone and four epoxy functional groups.